

Remarks

Claims 1-7 are pending in this application.

Claims 1-7 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Ueda et al. (U.S. Pat. 5,229,527) or Blechschmitt et al. (U.S. Pat. 4,077,984). This rejection is traversed. The applicants' invention relates to a process for the production of phthalic anhydride from o-xylene and naphthalene by using a catalyst bed comprising three distinct zones. The catalysts of the invention consist of a catalytically active material on an inert support. Each single catalyst has a specific activity which is mainly modulated by the total share of catalytically active material on the one hand and the catalysts' content of alkali metal on the other hand. More precisely, while the share of catalytically active material increases from one zone to the next in the direction of gas stream, the content of the alkali metal in the second zone may be the same as in the first zone or may be lower, while in the third zone the content of alkali metal necessarily has to be lower than that of the first zone.

Ueda et al. Employs catalyst beds that comprise only two zones "former-stage" and "latter-stage", cf. Col.3, lines 12-18).

Blechschmitt discloses a first catalyst zone containing rubidium and no phosphorus, while the second catalyst zone contains phosphorus and no rubidium. In each zone there may be sub-zones ("sub-layers") with lower amounts of the "allowed" chemical elements phosphorus or rubidium (col. 2, lines 50-59).

Thus, the invention claimed herein differs from that disclosed by each of the cited references in several significant respects, namely, three zones rather than two zones and

the nature of the catalyst. Neither reference is suggestive of the process claimed herein, and even if combined, the cited references would not be suggestive of the process claimed herein.. The examiner's rationale for concluding that the instantly claimed process is rendered obvious by the cited prior art is conclusory. Therefore, since no legal presumption of obviousness is established by the cited prior art, no showing should be required.

Assuming, *arguendo*, that a legal presumption of obviousness were raised the comparative test data already of record would effectively rebut the examiner's position. Examples 8 and 9 are based on the instant invention with the phosphorus content being 0.2 wt.%, and Examples 14 and 15 are based on the same catalysts as Examples 8 and 9 but with higher starting material loadings. Examples 10, 11, 12, and 13 were included for comparison purposes at low material loadings and Examples 16 and 17 for comparison at higher starting material loadings. The results reported in Table 1 of the application show improved running-up times and yields in Examples 8 and 9 over two-zone catalysts of the prior art in Examples 10 to 13 and, where running-up times/yield are similar (examples 11 and 12) an astonishingly low amount of phthalide, which is an unwanted by-product. The test data reported in Table 2 of the application show the results of experiments at higher starting material loadings (Examples 14 and 15 are according to the invention and Examples 16 and 17 are included for comparison purposes). Examples 14 and 15 demonstrate the superiority of our invention over the prior art as regards running-up times, 30 day average PA yield and purity (phthalide content). It is noted that Blechschmitt in his examples disclose highest loadings of only 60.3 g (example 1) and 49.2 g (example 2), each per cubic meter (S.T.P.) air. These results would not have been obvious to persons

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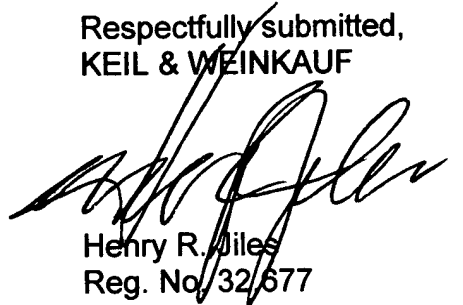
of ordinary skill.

In view of the foregoing remarks and the comparative test data reported in the applicants' specification, the applicants respectfully urge that the invention claimed herein is patentable, and a Notice of Allowance is solicited.

**Please find attached a check for \$920.00 for a three month extension of time fee.**

To the extent necessary, applicant(s) petition for an Extension of Time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including Extension of Time fees to Deposit Account No. 11-0345. Please credit any excess fees to such deposit account.

Respectfully submitted,  
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**VERSION WITH MARKINGS TO SHOW CHANGES MADE IN THE ABSTRACT**  
**ABSTRACT OF THE DISCLOSURE**

Phthalic anhydride is prepared by catalytic gas-phase oxidation of xylene and/or naphthalene by a gas comprising molecular oxygen in a fixed bed at elevated temperature and using at least three coated catalysts arranged in superposed zones, which catalysts have a layer of catalytically active metal oxides applied to a core of support material. In the process described, the catalyst activity rises from zone to zone from the gas inlet end to the gas outlet end and the activity of the catalysts of the individual zones is set such that the least active catalyst comprises a lower amount of active composition and, if desired, additionally more alkali metal selected from the group consisting of potassium, rubidium and cesium as dopant than the catalyst of the next zone and the subsequent even more active catalyst comprises the same amount of active composition and even less alkali metal as dopant or a greater amount of active composition and, if desired, less alkali metal as dopant than the catalyst of the second zone, ~~[with the proviso that]~~ with further conditions

- (a) ~~the least active catalyst on nonporous support material comprises from 5 to 9% by weight, based on the total catalyst, of active composition comprising 3 to 8% by weight of  $V_2O_5$ , from 0 to 3.5% by weight of  $Sb_2O_3$ , from 0 to 0.3% by weight of P, from 0.1 to .05% by weight of alkali metal (calculated as metal) and as balance  $TiO_2$  in antase from having a BET surface area of from 18 to 22  $m^2/g$ ,~~
- b) ~~the next more active catalyst has the same composition as catalyst (a) except for an active composition content which is from 1 to 5% by weight (absolute) higher and~~

~~an alkali metal content which is from 0 to 0.25% by weight (absolute) lower and~~  
c) ~~the most active catalyst has the same composition as (a) expected for an active~~  
~~composition content which is from 1 to 5% by weight (absolute) higher than in (a)~~  
~~and an alkali metal content which is from 0.15 to 0.4% by weight (absolute) lower~~  
~~than in (a)].~~

**COPY OF ALL CLAIMS**

1. A process for preparing phthalic anhydride by catalytic gas-phase oxidation of xylene and/naphthalene by a gas comprising molecular oxygen in a fixed bed at elevated temperature and using at least three coated catalysts arranged in superposed zones, which catalysts have a layer of catalytically active metal oxides applied to a core of support material, wherein the catalyst activity rises from zone to zone from the gas inlet end to the gas outlet end and the activity of the catalysts of the individual zones is set such that the least active catalyst comprises a lower amount of active composition and, if desired, additionally more alkali metal selected from the group consisting of potassium, rubidium and cesium as dopant than the catalyst of the next zone and the subsequent even more active catalyst comprises the same amount of active composition and even less alkali metal, as dopant or a greater amount of active composition and, if desired, less alkali metal as dopant than the catalyst of the second zone, with the proviso that
  - a) the least active catalyst on nonporous support material comprises from 5 to 9% by weight, based on the total catalyst, of active composition comprising from 3 to 8% by weight of  $V_2O_5$ , from 0 to 3.5% by weight of  $Sb_2O_3$ , from 0 to 0.3% by weight of P, from 0.1 to 0.5% by weight of alkali metal (calculated as metal) and as balanced  $TiO_2$  in anatase form having a BET surface area of from 18 to 22  $m^2/g$ ,
  - b) the next more active catalyst has the same composition as catalyst (a) except for an active composition content which is from 1 to 5% by weight

(absolute) higher and an alkali metal content which is from 0.025% by weight (absolute) lower and

- c) the most active catalyst has the same composition as (a) except for an active composition content which is from 1 to 5% by weight (absolute) higher than in (a) and an alkali metal content which is from 0.15 to 0.4% by weight (absolute) lower than in (a).
2. A process as claimed in claim 1, wherein cesium is used in amounts of from 0.25 to 0.5% by weight as alkali metal in the least active catalyst.
  3. A process as claimed in claim 1, wherein the activity of the individual catalysts is set such that the most active catalyst comprises the same amount or a greater amount of active composition and less alkali metal as dopant than the catalyst of the second zone.
  4. A process as claimed in claim 1, wherein the activity of the individual catalysts is set such that the catalyst of the second zone comprises a greater amount of active composition and less alkali metal as dopant than the catalyst of the first zone.
  5. A process as claimed in claim 1, wherein the activity of the individual catalysts is set such that the catalyst of the second zone comprises the same amount of active composition and more alkali metal as dopant than the most active catalyst.
  6. A process as claimed in claim 1, wherein the catalyst (a) has an active composition content of from 6 to 8% by weight comprising from 4 to 8% by weight of  $V_2O_5$  and from 0.3 to 0.5% by weight of Cs (calculated as Cs), the catalyst (b) has an active composition content of from 8 to 12% by weight comprising from 0.2 to 0.5% by

weight of Cs and the catalyst (c) has an active composition content of from 8 to 12% by weight comprising from 0 to 0.3% by weight of Cs.

7. A process as claimed in claim 1, wherein the catalyst (a) has an active composition content of from 7 to 8% by weight comprising from 6 to 8% by weight of  $V_2O_5$  and from 0.3 to 0.4 % by weight Cs, the catalyst (b) has an active composition content of from 9 to 11% by weight comprising from 0.2 to 0.4% by weight of Cs and the catalyst(c) has an active composition content of from 9 to 11% by weight comprising from 0.05 to 0.2% by weight of Cs.